bones are few and expanded; the nasals, pre-frontals, and lacrymals are represented by a single bone, and there are no superorbitals. There is no *second* temporal bone, as in lizards, but an additional cheek-bone, the *quadrato-jugal*, unites the jugal to the pier of the lower jaw, a very exceptional thing in lizards (*e.g.*, *Hatteria.*)

The large investing bones have to a great extent aborted the proper internal skull; this is especially the case between the capsules of the ears and the labyrinths of the nose.

In the logger-head and green turtles the cranial compartment has a "shed" or "lean-to" on each side, formed by the parietals, post-orbitals, and squamosals. The pterygoids form the greater part of the bony floor of the skull, between which and the descending wall there is a little bony "prop" corresponding to the *columella* (*epipterygoid*) of the lizard.

The mandible has no *splenial* element, as in bony fishes and frogs. There are two arches developed behind the mandible—the hyoid, or tongue arch, and a second, corresponding to the first gill arch in fishes and Amphibia. The pier of the arch of the lower jaw (*quadrate*) is hollowed into a drum, over which is stretched its "opercular fold," as the parchment, in which there is an annular cartilage. The pier of the tongue-arch is a long slender rod, the *columella*, the proximal part of which answers to the stapes, and the rest to the incus; it stretches between the *fenestra ovalis* and the drum membrane.

This peculiar hollowing out of the quadrate is a promise of the air-cells seen in many of the bones of birds.

The development of the embryo of the Chelonia takes place in essentially the same manner as in birds; yet, in the young of the green turtle, half an inch long, the rudiments of the carapace can be seen.

The parental form of all the modern Chelonia was probably intermediate between the extinct *Rhynchosauria* and the *Plesiosauria*, and the existence in the Cape toad (Dactylethra) of characters that correspond very closely with those of the Chelonia, suggests a relationship between certain ancient forms of the Batrachia and the generalised types from which the Chelonia have sprung.

(*To be continued.*)

GEOGRAPHICAL NOTES

It would appear as if the War Office authorities expected the special service officers who are on the point of starting for Zululand to find opportunities for doing useful geographical work in that country, as we understand that the Intelligence Department are supplying them with the most recent edition of "Hints to Travellers," published under the authority of the Council of the Royal Geographical Society, and edited by Mr. Francis Galton, F.R.S.

The news of the death of the Marquis Antinori, the leader of the Italian Expedition to Central Africa, is, we are glad to say, contradicted.

The Congress of Commercial Geography, to be held at Brussels in September, will be presided over, not by M. Bamps, but by Lieut.-General Liagre, president of the Belgian Geographical Society and perpetual secretary of the Belgian Academy of Sciences. M. du Fief will act as secretary.

News from Leipzig states that the president of the Meteorological Office of that city, Baron A. von Danckelmann has been invited by M. Sibiriakoff to take part in the expedition to the Siberian Arctic Sea, and that he has accepted the invitation, the necessary permission having been readily granted to him by the Saxon Government. The expedition was to sail on May 14.

Les Missions Catholiques publishes an interesting communication from Père Gourdin, a missionary in the Chinese province of Szechuen, in which he gives an account of the little-known tract of country in the south of the province, called Kienchang.

The last report of Her Majesty's Consul at Newchwang contains much information in regard to Manchuria which is of interest from the standpoint of commercial geography. There are reasons for believing, in his opinion, that in spite of the watershed between the valleys of the Liao and the Sungari, Newchwang will successfully compete with Nicholayesk for the most valuable part of the trade with the latter valley, and those of the two great affluents of the Sungari, the Nonni and the Hurka. A great point in its favour is that the Liao River is remarkably easy of access, while the navigation of the Amur at its entrance is extremely intricate, and is closed by ice for seven months in the year. Colonisation, we are told, is proceeding in the valley of the Yalu-Kiang, the boundary between China and Corea. With regard to the production of opium in regions at a distance from Newchwang, Mr. Consul Adkins says that it is growing in most parts of the province of Fêngtien (South Manchuria), in many parts of the Kirin province, and in a daily increasing area in the southern portion of Eastern Mongolia, notably in the tract of country which lies on the right bank of the Sungari in the angle formed by the reaches of that river above and below its junction with the Nonni, east and south-east of Petuna.

A further instalment of the *Transactions* of the Asiatic Society of Japan, which has just come to hand, contains some interesting notes of a visit paid last year to the little-known island of Hachijô by Mr. F. V. Dickens and Mr. Ernest Satow, the Japanese Secretary of H.M.'s Legation at Yedo. The island in question, it may be useful to note, is erroneously called Fatsizio on our Admiralty chart; it is the last but one of the chain which extends south of the promontory of Iazu in almost a straight line.

In a brief account of the work of the China Inland Mission in Burmah we find some notes of interest respecting a visit to the Kah-chen hills near the Chinese frontier. The village visited is situated among the mountains at an elevation of 4,000 feet above the Burmese town of Tsee-kaw. The Kah-chen houses are described as being built of bamboo, and more substantially than those of the Burmese. The roof of each is about 100 or 150 feet in length; at the entrance for some 15 feet the sides are open or merely formed of open bamboo work. The poles which support the roof of this part of the building are ornamented with the heads and horns of buffaloes sacrificed to the *nats* or spirits. On either side of a long passage are small rooms, the first of which is the guest chamber; the kitchen and general sitting-room is at the end of the passage, whence a door, always open, leads into a small raised veranda and which is entirely appropriated to the use of the *nats*, of whom the people are in great dread. The dress of the women is superior to that of their Burmese sisters, than whom they are said to be more modest. All who can afford it, wear a large silver hoop round the neck, and as many strings of red, green, blue, and white beads as they can muster. Their ear ornaments are peculiar; large flaps of ornamented cotton hang from the back of the ear, and tassels or silver tubes are passed through the lobes. All wear large coils of rattan round their bodies, and the younger ones wear bells and cowrie shells. There is, however, one objection to both men and women, viz., their great want of cleanliness.

NOTES

The University of Edinburgh has sustained a great loss in the unexpected death of its veteran and genial professor of mathematics. Only three weeks ago, in giving the annual address at the graduation ceremonial, he in touching terms alluded to his long length of service, and the improbability of his again addressing the collected body of graduates. The labours of the winter session had proved too much for his enfeebled health. Immediately after their close he left for the country, where he seemed at first to revive, but a cold which he caught brought on congestion of the lungs, against which he had not strength to rally. He died on the 7th inst. His eminence as a mathematician, and his excellence as a teacher, combined with his admirable personal qualities, will be long remembered by all who have known the Edinburgh University during the last forty years.

THE death is announced of Prof. Grisebach, the well-known botanist and geographer. He was born in 1814 at Hanover, and in 1841 was called as Professor of Botany to Göttingen, where he was still officiating up to his death. He contracted his illness while on a visit with his family to Italy.

M. PASTEUR is about to found, in the department of the Jura, with the support of the French Minister of Agriculture and Commerce, who has for this purpose granted a subvention of 1,000*l*., a special laboratory for the study of all questions connected with the vine and wine. This laboratory, provided with all the means of investigation which bear on researches of this nature, will be located at Arbois, and M. Pasteur will devote six months each year to it. Important results may justly be looked for from this institution.

THE Baly Medal of the Royal College of Physicians of London has been awarded to Mr. Chas. Darwin, F.R.S.

HERR KARL BOCK, who, at the request of the late Marquis of Tweeddale, has spent eight months in exploring the highlands of Sumatra, has, the *Times* states, returned to Padang with a rich collection of natural history specimens. Among other living animals he has secured a specimen of the *Capricornis sumatrensis*, which is peculiar to the island. It is a species of mountain antelope, rarely met with, and only among the most remote and almost inaccessible peaks. Herr Bock was travelling in Lapland in the autumn of 1877, under the 71st parallel of north latitude. The autumn of 1878 was spent by him under the first parallel of south latitude.

A SERIES of "Davis" lectures upon zoological subjects will be given in the lecture-room of the Zoological Gardens, in the Regent's Park, on Thursdays at 5 P.M. The first was given last Thursday by Prof. Flower, on "Birds that do not Fly." The others are as follow:—May 15, "The Pleasures of Zoology," Prof. J. Reay Greene, M.D.; May 22, "Tails," Prof. Mivart, F.R.S.; May 29, "Parrots," P. L. Sclater, F.R.S.; June 5, "Snakes," Prof. Huxley, F.R.S., ; June 12, "Nocturnal Animals," Dr. J. Murie, LL.D., F.L.S.; June 19, "Reptiles and their Distribution," P. L. Sclater, F.R.S. These lectures will be free to Fellows of the Society and their friends, and to other visitors to the Gardens.

MR. ORVILLE A. DERBY contributes to the *Rio News* some interesting information on the plague of rats in Brazil. From time to time in all parts of Brazil the plantations are subject to the depredations of armies of rats that issue from the forests and consume everything edible that comes in their way. During a recent excursion in the province of Paraná Mr. Derby found an almost universal lack of corn throughout the province, due to such invasion of rats, by which almost the entire crop of last year had been destroyed. This invasion, or plague as it is called, is said to occur at intervals of about thirty years, and to be simultaneous with the drying of the *taquara*, or bamboo, which everywhere abounds in the Brazilian forests. The popular explanation is that every cane of bamboo sprouts with a grub, the germ of a rat, within it, and that when the bamboo ripens and dies the germ becomes a fully-developed rat and comes out to prey on the plantations. An educated and observant Englishman, Mr. Herbert H. Mercer, who has resided a number of years in the province and had an opportunity of studying the phenomenon, furnished Mr. Derby the following rational and curious explanation:—The bamboo arrives at maturity, flowers and seeds at intervals of several years, which doubtless vary with the different species. The period for the species most abundant in Paraná is thirty years. The process, instead of being simultaneous, occupies about five years, a few of the canes going to seed the first year, an increased number the second, and so on progressively, till finally the remaining and larger portion of the canes seed at the same time. Each cane bears about a peck of edible seed, resembling rice, which is very fat and nourishing, and is often eaten by the Indians. The quantity produced is enormous, and large areas are often covered to a depth of five or six inches. After seeding the cane dies, breaks off at the root and falls to the ground, the process of decay being hastened by the borings of larva which live upon the bamboo and appear to be particularly abundant at seeding time. These larva have doubtless given rise to the story of the grub developing into a rat. New canes spring up from the seed, but require seven or eight years to become fit for use, and thirty to reach maturity. With this sudden and constantly increasing supply of nourishing food for a period of five years, the rats and mice, both of native and imported species, increase extraordinarily in numbers. The fecundity of these animals is well known, and the result after four or five years of an unusual and constantly increasing supply of excellent food and in the absence of enemies of equal fecundity, can readily be imagined. The last of the crop of seed being mature and fallen to the ground, the first rain causes it to decay in the space of a very few days. The rats, suddenly deprived of food, commence to migrate, invading the plantations and houses and consuming everything that does not happen to be repugnant to the not very fastidious palate of a famishing rodent. If this happens at the time of corn planting, the seed is consumed as fast as it can be put into the ground. Mr. Mercer, who plants annually about fifty acres of corn, replanted six times last year, and finally gave up in despair. The mandioca is dug up; the rice crop, if it happens to be newly sown or in seed, is consumed, as is also everything in the houses in the way of provisions and leather, if not carefully guarded in tin trunks.

THE Congress of the Social Science Association at Manchester has been fixed to take place from October 1 to 8.

Deutsche Acclimatisation is the title of a new German journal devoted to questions connected with the acclimatisation, training, and breeding of birds. It is the organ of the German Society for the Breeding and Acclimatisation of Birds, and will appear at irregular intervals. The editor is Dr. Reichenow.

THE cryptogamous division of the herbarium of the Boston (U.S.) Society of Natural History, we learn from the *American Naturalist*, has been enriched by the discovery of a valuable collection of lichens. This was formerly the lichen-herbarium of Dr. Thomas Tayler, an Irish botanist, to whom Sir W. J. and Sir Joseph Hooker gave the whole of their extensive collection of lichens, gathered during many exploring expeditions. Dr. Tayler published descriptions of these plants in the *Journa of Botany*, 1844-66, and many of the specimens are the originals of the descriptions. In 1850 Mr. John A. Lowell purchased the collection from Dr. Tayler's heirs, and it formed a part of the herbarium subsequently presented by him to the Society.

THE following (*ben trovato*, if not the other thing), seems worth reproducing from *Science News*:—It is not long ago that a young man went to one of the wise men at the Smithsonian Institution, and said: "I think I should like to be a naturalist." "Well, *be* one," replied the doctor in charge. "But I don't know how, and wish you would get me rightly at work at the start." "Very well," said the willing master, "there is plenty to be done right here; let us begin on these fishes." Turning to a can of fishes from Arizona in spirits, he opened the cover, pulled up his sleeve, and brought forth two or three dripping examples. They were well preserved, but the smell—well, the less said about that the better; it was very "ancient" and somewhat "fish-like." "There, see what more you can get out of that can, and I'll show you what to do next." The young man paused in dismay and tugged very gently at his kid glove. Finally, in deprecating tones he asked: "Doctor, is it necessary, in order to become a naturalist, that I plunge my hands in that alcohol?" "Of course—no other way to study objects of natural history properly, except in the field." "Well," was the reply, very decided, albeit somewhat rueful, "I—I think I'll go back to Long Branch." And go back he did.

Dr. Hopkinson gave important evidence before the Electric Lighting Committee last Friday. As a result of his experiments, he found that on an average about 87 per cent. of the mechanical energy bestowed on the machine was converted into heat, but about 50 per cent. of the electricity obtained from the mechanical energy was lost in the heating of the machine and wires. The scientific considerations, he stated, had largely been touched in a satisfactory manner. Mr. Shoolbred, of the firm of Shoolbred and Co., Tottenham Court Road, gave satisfactory evidence of the working of the light in his establishment. He was burning twenty candles, which had replaced 230 gas burners. The cost to him was 37*s.* 3*d.* per night in winter, and 9*s.* 10*d.* in summer.

The American papers state that Mr. Edison is still engaged in his experiments with reference to the electric light, and hopes yet to overcome all difficulties, and to make the light available for public use. He intends to institute a comparative trial on carbon lamps between his own machine and those of Wallace and Gramme; he does not say how many carbon lamps he can light with his machine. He is confident that he can work his system for street and house-lighting with comparatively little loss by exhaustion of the current, by means of a cable, from a central station, the cable composed of as many strands of wire, say one-sixteenth inch diameter, as there are houses in the street to be lighted. The latest papers say that Mr. Edison has perfected his dynamo-electric machine, and with that he maintains he has solved the problem of the economical generation of electricity and the sub-division of the light. A trial of his system is stated to have worked perfectly, producing more lights and less heat with less expenditure of power than any machine hitherto constructed.

The Meudon Aërostatic Service officers are constructing a directing balloon with screw moved by a steam-engine. They have desisted from their original scheme, which was to attach the screw to the equator of the balloon, and have acknowledged reluctantly the necessity of adopting the principles used by M. Henry Giffard, in his celebrated 1852 hippodrome experiment with a steam directing aërostat.

According to official statistics 22,851 wild animals and 127,295 serpents were destroyed in India during 1877; while 16,777 persons died from the bites of serpents, and 2,918 were killed by tigers, leopards, wolves, and other wild animals.

Akhbar, the most influential French paper in Algeria, is devoting many interesting articles to the construction of the Trans-Saharan railway from Laghouat to Timbuktu through Touat. The preliminary surveys have been executed from the Algiers-Oran line to Laghouat.

The last number of the Russian Physical and Chemical Society's *Journal* (vol. xi. fasc. 3) contains the annual reports of the Society, and papers on the temperatures of boiling of saturated hydrocarbons of normal structure, by M. J. Goldstein; on benzoic compounds, by M. P. Goloubeff; on aromatic compounds, by M. E. Wroblevsky; and on the transmission of a galvanic current in water when the platina electrodes are of various sizes, by M. Slouginoff.

In a recently-published inaugural dissertation on the electromotive forces which occur in free water jets (*Ann. der Phys.*, No. 4), Herr Elster arrives at these conclusions:—1. A liquid motion *per se* produces no electromotive force. (This is against Edlund's view). 2. Capillary electric currents are simply produced by friction of the particles of the moved liquid; in the case of non-wetting liquids, by their friction on the particles of the solid wall, and in the case of wetting liquids, by friction on the particles of a layer of the liquid condensed on the surface of the solid, this layer behaving to the less dense as a heterogeneous substance. 3. The capillary electric currents discovered by Quincke are identical with the friction-currents which occur in the rubber of an electric machine, and which were first observed by Zöllner. Numerous experiments in support of these conclusions are described.

News has been received from Japan that two very rich seams of coal have just been discovered in the celebrated Takashima mines. It is estimated that they will produce fully a million tons of coal. It is also reported that active measures are being taken for throwing open to foreign commerce the ports of Tsuruga and Shimonoseki.

The first of two illustrated volumes, on the Manufacture of Sulphuric Acid and Alkalis, by Prof. Lunge, of Zurich, will be published in a few days by Mr. Van Voorst, who has also just ready for publication a supplement to C. Greville Williams's "Handbook of Chemical Manipulation."

The fourth public annual meeting of the Sunday Society will be held in Freemasons' Tavern on Saturday, at 4 P.M. From their just published Report we see that the Society is making marked progress in the objects which they have in view.

The supplement to the *Colonies and India* for May 10 contains a long address given to the Colonial Institute by Prof. Owen on the Extinct Animals of the Colonies of Great Britain.

We have received a most interesting and instructive lecture on Ornithology, by Dr. H. B. Hewetson, of Leeds; its title is "Nature Cared for and Nature Uncared for, the Result upon the Hearts of Men." He tries to show how much pure pleasure can be derived from the observation of living nature, and the study not of the dead animal, but of "the life-sympathies and instincts of the object in life." The lecture deserves a wide circulation. The publishers are West, Newman, and Co., of London.

The additions to the Zoological Society's Gardens during the past week include a Macaque Monkey (*Macacus cynomolgus*) from India, presented by Mr. C. A. Thomson; an Ocelot (*Felis pardalis*) from America, presented by Mr. P. Leckie; an Indian Kite (*Milvus govinda*) from East Asia, presented by Capt. Murray; a Common Chameleon (*Chamæleon vulgaris*) from North Africa, presented by Mr. A. Dodd; a Diana Monkey (*Cercopithecus diana*), a Subcylindrical Hornbill (*Buceros subcylindricus*) from West Africa, received in exchange; a Macaque Monkey (*Macacus cynomolgus*) from India, five Peacock Pheasants (*Polyplectron chinquis*) from Burmah, deposited; twelve Common Teal (*Querquedula crecca*), twelve Garganey Teal (*Querquedula circia*), twelve Red-headed Pochards (*Fuligula ferina*), six Tufted Ducks (*Fuligula cristata*), four Shovellers (*Spatula clypeata*), two Common Pintails (*Dafila acuta*), two Common Widgeons (*Mareca penelope*), European, purchased; an Hybrid Markhoor (*Capra megaceros*), six Seven-banded Snakes (*Tropidonotus leberis*), born in the Gardens.